Accepted: 21/12/2023, Revised: 31/03/2024, Published: 31/07/2024

EFFECT OF DEXTRIN ON WATER ACTIVITY, CRUDE FIBER, PHENOLICS, AND ORGANOLEPTIC FRUIT LEATHER GUAVA CRYSTAL-DRAGON FRUIT SKIN

Bambang Dwiloka*, Leony Dewi Sabella, Rafli Zulfa Kamil

Food Technology Study Program, Faculty of Animal Husbandry and Agriculture, Universitas Diponegoro Semarang
Prof. Jacub Rais Street, Tembalang, Semarang, 50275 Central Java Indonesia
*Corresponding Author, Email: bambangdwilokaundip@gmail.com

ABSTRACT

The goal of this study was to investigate the impact of varying concentrations of dextrin in fruit leather on attributes such as crude fiber content, total phenols, and organoleptic. The study was carried out utilizing a fully randomized design, implementing four interventions that included adding dextrin at various concentrations: (P_0) 0%, (P_1) 1%, (P_2) 2%, and (P_3) 3%, each replicated five times. The test results showed a_w value of 0.40 - 0.42; crude fiber 6.31 - 7.76 g/100 g; total phenols 2.61 - 3.22%, color score 1.92 - 2.68; aroma 2 - 2.8; taste 2.24 - 2.6; and texture (plastic) 2.12 - 2.68. The test results for total phenols tend to show an increase. Increasing the concentration of added dextrin reduces the crude fiber, aroma, and taste but increases the color and texture (plasticity) of fruit leather.

Keywords: Crude fiber, Dextrin, Organoleptic, Phenol

INTRODUCTION

Currently, the guava variety that is gaining popularity among the general public is the crystal guava, which is known for having few seeds. Crystal guava is characterized by a bumpy fruit surface, thick flesh, and crispness (Suhendar, 2021). This crystal guava has only about 3% seeds, and its fruit weight varies between 250 to 500 grams, with a high content of pectin and vitamin C (Trubus, 2014). However, crystal guava fruit is prone to spoilage, so innovation in handling or processing was needed to extend its shelf life. A processing innovation that can be developed is fruit leather, a soft and elastic sheet product made from fruit puree.

The process of making fruit leather involves heating it, which can cause browning, resulting in an unattractive brown color. To improve the color of fruit leather, dragon fruit peel puree is added to provide a bright red color due to its high anthocyanin pigment content (Ingrath et al., 2015). Research by Putri et al. (2015) stated that red dragon fruit skin has higher phenols, vitamin C, and antioxidants than the pulp and has higher dietary fiber than citrus fruits, pears, and peaches (Susanto and Saneto, 1994).

In the development of crystal guava fruit leather, additional ingredients in the form of fillers, such as dextrin, are needed, which functions as a binder to improve the properties of guava pulp, which has a high water content. The use of dextrin at 50°C obtained red guava fruit leather that was more favorable than the use of gum Arabic or tapioca. Dextrin, as a type of oligosaccharide, has properties that are not thick, soluble, and quickly dispersed, facilitating drying because the water bound to dextrin is quickly evaporated (Arief, 2018). Research by Yahya et al. (2022) found that the addition of dextrin at a concentration of 2% gave the best results in terms of physico-chemical properties of red guava fruit leather, but the study had a low score for color and texture characteristics.

This research aimed to investigate the effects of varying dextrin levels on several parameters, including water activity (a_w), crude fiber content, total phenols, and organoleptic

properties of crystal guava-dragon fruit leather. This research was expected to contribute to the efforts to diversify the crystal guava-dragon fruit leather-based products by determining the optimal dextrin concentration to produce fruit leather that has good organoleptic properties and was favored by the public.

MATERIALS AND METHODS

The research took place from August to September 2023 and was conducted at the Food Chemistry and Nutrition Laboratory and the Food Engineering and Agricultural Products Laboratory of the Faculty of Animal Husbandry and Agriculture, Diponegoro University, for sample preparation, water activity analysis (a_w), and organoleptic properties test. In addition, part of the research was carried out at CV Chem-Mix Pratama, Yogyakarta, to analyze crude fiber content and at the Analysis and Measurement Service Laboratory of the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Brawijaya University, to analyze the total phenols. The focus of this research is on the manufacture of fruit leather from crystal guava and dragon fruit peels, as well as testing parameters such as water activity, crude fiber content, total phenols, and organoleptic properties of the fruit leather products.

Material

The materials in this research are crystal guava fruit and dragon fruit peel obtained from the Keboen Buah shop, Banyumanik, Semarang. Other materials are dextrin purchased online from Indoplant chemical store, Yogyakarta, sugar brand "Gulaku", citric acid, mineral water, distilled water, H_2SO_4 1.25%, NaOH 1.25%, ethanol 96%, sulfinate acid 7.64%, $NaNO_2$ 4.8%, NaOH 8%, and phenol standard solution.

Tools

Tools in the research include knives, basins, digital scales, sieves, spoons, analytical scales, spatulas, blenders (Philips, Netherlands), pans, stoves, baking sheets, plastic baking, cabinet dryers, measuring cups, thermometers, a_w meter (Novasina, Switzerland), erlenmeyers, water baths (MEMMERT, Germany), filter paper, litmus paper, ovens, UV-Vis spectrophotometers (BIOBASE, China), refrigerators, and serving plates.

Research Design

This research applied a completely randomized design (CRD) with four treatment conditions and five repetitions, resulting in a total of 20 trials. The treatments tested involved variations in dextrin concentration, namely P0 = 0% (no dextrin added), P1 = 1%, P_2 = 2%, and P_3 = 3% (w/b fruit puree mixture). In this study, the hypothesis was that the addition of dextrin at varying concentrations could potentially affect the properties of the crystal guava-dragon fruit leather, including the a_w value, crude fiber content, and organoleptic attributes. Empirically, the hypothesis in the research is interpreted as follows.

H_0 : There is no effect of dextrin addition concentration on the a_w value, crude fiber content, and organoleptic properties of crystal guava fruit leather-dragon fruit skin.

H_1 : Dextrin addition concentration has an effect on the a_w value, crude fiber content, and organoleptic properties of crystal guava fruit leather-dragon fruit skin.

The hypothesis acceptance criteria applied in this study are as follows: if the p value> 0.05 (with a significance level of α=0.05), then the null hypothesis (H_0) will be accepted, and the alternative hypothesis (H_1) will be rejected; conversely, if the p-value < 0.05 (with a significance level of α=0.05), then H_0 will be rejected and H_1 will be accepted.

Research Stages

Making fruit leather is done by making crystal guava fruit puree, namely crystal guava, which is washed with running water and peeled. Furthermore, the crystal guava seeds are cleaned and removed from the pulp. The fruit was then cut into small dice. The pieces are then pureed with a blender where the ratio of crystal guava fruit and water is 2:1. The next

step in the procedure is to make dragon fruit peel puree; the outer skin of the dragon fruit is cleaned, weighed, washed with running water, cut into small pieces, and then mashed using a blender with the ratio of dragon fruit peel and water as much as 1:1.

The fruit leather was made by mixing dragon fruit peel puree and crystal guava fruit puree in the ratio of 20% dragon fruit peel puree and 80% crystal guava puree, sugar was added at 10% of the total fruit puree mixture, citric acid was added at 0.1% (w/b fruit puree mixture), and dextrin was added according to the treatment, namely 0%; 1%; 2%, and 3% (w/b fruit puree mixture). The mixture was then cooked at 90°C for 5 minutes. The mixture was stirred evenly and poured into a baking pan lined with baking plastic. Fruit leather was flattened to the same thickness and then dried using a cabinet dryer at 60°C for 8 hours.

Analysis Procedure

Value a_w

The water activity number (a_w) in crystal guava fruit leather-dragon fruit leather was measured according to the AOAC (2007) method using a_w meter. The a_w meter was turned on and left until the heating process of the device was complete. The fruit leather sample was then placed in the testing container of a_w meter. The analysis is carried out automatically by the device. After the analysis process is complete, an alarm will sound, and the water activity value will appear on the display screen.

Crude Fiber

Testing the crude fiber content of fruit leather refers to the SNI ISO 5498: 2015 standard. This analysis process starts with smoothing the material until it can be sifted, ensuring that the material is free of fat or oil. Then, 1 g of the sample was weighed and put into a 250 ml Erlenmeyer flask. Then, 200 ml of H_2SO_4 1.25% was added to the mixture, and then the mixture was heated using a water bath at 100°C for 30 minutes while stirring continuously. After this step, it was filtered using filter paper and then washed with hot water until it reached neutrality, which can be tested with litmus paper. The remaining residue was then transferred by quantitative method into a 250 ml Erlenmeyer flask; the remaining residue was washed with 200 ml of 1.25% NaOH solution. The mixture was then reheated using a water bath at 100°C for 30 minutes with continuous stirring, after which it was filtered using constant filter paper of known weight (a). The remaining residue was then rinsed with 15 ml of 96% ethanol and then rinsed with hot water until neutrality, which can be tested using litmus paper. The residue on the filter paper is dried using an oven at 100°C until it reaches a constant weight, then weighed on the filter paper that has reached a constant weight (b). The formula for calculating crude fiber content is as follows:

$$\text{Crude fiber} = \text{b - sample weight} \times 100\%$$

Description:
a = weight of ash (g)
b = weight of sample after oven (g)

Total Phenol

Total phenol content refers to the method described by Lukiati (2014), where phenol content was determined using the spectrophotometric method for each extract. This process involves the addition of reagent A (a mixture of 7.64% sulfinic acid, H_2SO_4 , $NaNO_2$ 4.8%, in a ratio of 5:1:5) of 1 ml to the extract, followed by the addition of reagent B (NaOH 8%) of 0.5 ml, then, the sample is incubated at 10 ℃ for 30-40 minutes, after which the absorbance is measured using a UV-Vis spectrophotometer at a wavelength of 360 nm. The absorbance measurement of the sample was compared with the phenol standard. Standard solutions of phenol were prepared at concentrations of 1, 2, 3, and 4 ppm, and the absorbance was measured in a similar manner.

Organoleptic Test

Organoleptic assessment in this study used descriptive organoleptic test. Organoleptic assessment refers to (Permadi et al., 2018), namely assessing fruit leather samples by 25 trained panelists, and is carried out by providing assessment form paper and fruit leather samples that have been cut by presenting approximately 5 × 1 cm from each treatment for each panelist. The test began by placing the sample and paper form on the panelist table. The paper form contains the identity of the panelist, instructions, test instructions, and panelist responses according to the parameters requested, namely color, aroma, taste, and texture, which are assessed on each sample. Samples were placed on a tray and randomly coded with three numbers. The sample code was obtained through sampling with a replacement system by making a lottery number 0 - 9 and put into a bowl, then randomized, and taken one paper containing a random number became the first code of the sample, then the paper was returned to the bowl then randomized and taken one paper containing a random number and became the second code of the sample. The method is repeated until a three-digit sample code is obtained for all samples. Samples for P_0 obtained code 521, P_1 obtained sample code 174, P_2 obtained sample code 890, and P_3 obtained sample code 655. Each panelist was asked to try the product and give an assessment on the paper form that had been given. The assessment was carried out using a score system 1-4. For the color, score 1, indicating not bright, score 2, indicating moderate bright, score 3, indicating bright; and score 4, indicating very bright. For the aroma score 1, indicating not strong, score 2, indicating moderate strong, score 3, indicating strong; and score 4, indicating very strong. For the texture, score 1, indicating not plasticity, score 2, indicating moderate plasticity, score 3, indicating plasticity; and score 4, indicating very plasticity. For the taste, score 1, indicating not acidic, score 2, indicating moderate acidic, score 3, indicating acidic; and score 4, indicating very acidic. Mineral water was provided to the panelists as a neutralizer during the taste test. Panelists were asked to evaluate the samples on a prepared form for each sensory attribute.

Data Analysis

Data regarding a_w value and crude fiber content were analyzed using ANOVA with a significance level of 0.05. If there was a significant effect, the analysis was continued with the DMRT test to identify differences between each treatment. Meanwhile, data on organoleptic properties scores were analyzed through Kruskal Wallis test with a significance level of 0.05. If there was a significant effect, further analysis using the Mann-Whitney test was used to evaluate the differences between each treatment. All data analysis obtained was done by computer through the application of the SPSS version 26.0 program for Windows. For the total phenol parameter, the analysis was done descriptively by presenting it in a table and then explained.

RESULTS AND DISCUSSION

The results of research on the effect of different concentrations of dextrin on a_w and crude fiber of crystal guava fruit leather - dragon fruit skin obtained data on the value of a_w and crude fiber, as can be seen in Table 1.

Table 1. a_w and Crude Fiber Values of Crystal Guava Fruit Leather-Dragon Fruit Leather

Treatment	Concentration of dextrin as additive (%)	Parameters	
		a_w	Crude fiber (%)
P_0	0	0.41 ± 0.01^{a}	7.76 ± 0.53^{a}
P_1	1	0.42 ± 0.01^{c}	7.51 ± 0.33^{a}
P_2	2	0.40 ± 0.00^{b}	6.56 ± 0.59^{b}
P_3	3	0.40 ± 0.00^{ab}	6.31 ± 0.48^{b}

Note: the use of superscripts in different lowercase letters in the same column indicates a significant difference (p<0.05).

1. Rated a_w Crystal Guava Fruit Leather-Dragon Fruit Leather

Based on Table 1. obtained the average value of water activity (a_w) ranged from 0.40 to 0.42. This range meets the criteria of a_w which is good for fruit leather, according to the research of Fauziah et al. (2016), stated that quality fruit leather has a_w value of not more than 0.7. All treatments in this study met the maximum limit of a_w value for fruit leather, thus reducing the possibility of growth and development of microorganisms and allowing crystal guava fruit leather-dragon fruit leather to have a longer shelf life in closed storage conditions at room temperature. In Table 1, it is also noted that the addition of dextrin in low concentration as an additive to crystal guava-dragon fruit leather can increase the a_w value. However, as the dextrin concentration increases, the a_w value tends to decrease. The increase in a_w value is due to the effect of the type of binder added. Increasing dextrin concentration causes an increase in product water content because dextrin is a polysaccharide with a simple chemical structure consisting of 1,6 α-glucosidic and 1,4 α-glucosidic bonds (Xu et al., 2012). Dextrin has a good ability to absorb water compared to other fillers that have complex chemical structures (Alftrén et al., 2012).

The decrease in a_w value that occurs along with the increase in dextrin concentration is also due to the nature of dextrin as a stabilizer in fruit leather, which is easily soluble in water so that it can accelerate the evaporation of water, the a_w value is low. This is supported by the research of Arief et al. (2018), which states that the addition of dextrin stabilizer produces red guava fruit leather with the lowest water content due to dextrin being easily soluble in water but quickly dispersed and not thick, so it functions as a stabilizer. Thus, the process of evaporation of water bound by dextrin can take place quickly, causing low water content. Dextrin functions as an adhesive agent that supports the drying process (Kumalaningsih et al., 2005). Meanwhile, the correlation between moisture content and a_w value shows that as the moisture content increases, the a_w value also increases. An increase in the a_w value of a food ingredient tends to be associated with a decrease in the shelf life of the food, while a low a_w value indicates a higher level of shelf life in the food ingredient (Ramadhan et al., 2015).

2. Crude Fiber Content of Crystal Guava Fruit Leather-Dragon Fruit Leather

Data analysis shown in Table 1. explained the significant difference ($p<0.05$) in P_0 and P_1 with P_2 and P_3, but in the treatment of P with P_{01} and P_2 with P_3 is not significantly different ($p>0.05$). The lowest crude fiber content in fruit leather was P_3 (6.31 ± 0.48)%, and the highest fiber content in fruit leather was P_0 (7.76 ± 0.53)%. Crude fiber is an element in food that cannot be decomposed by acids and bases that have high strength. Based on Table 1, it is also known that the average crude fiber content is in the range of 6.31% to 7.76%. Increasing dextrin concentration has a tendency to reduce crude fiber content, although it remains higher than crude fiber in raw materials. Based on the Ministry of Health of the Republic of Indonesia (2018), crystal guava contains 4.5 g of crude fiber per 100g. The decrease in the amount of crude fiber in fruit leather is influenced by the water content in the product. Crude fiber content tends to decrease with increasing water content because there is an inversely proportional relationship. The addition of dextrin in fruit leather serves to bind the free water in the product, turning it into bound water. This phenomenon is similar to the findings of Kania et al. (2015), who suggested that one of the characteristics of dextrin is its ability to retain free water in a material, and increasing the amount of dextrin can reduce the free water content. As a result, the bound water content in fruit leather is higher, and the impact is a decrease in crude fiber content. According to Manurung et al. (2018), the presence of low fiber content can be due to the impact of the processing process and the duration of drying applied.

3. Total phenolics of Crystal Guava Fruit Leather-Dragon Fruit Leather

The total phenolics of crystal guava-dragon *fruit* leather with different dextrin additions can be seen in Table 2.

Table 2: Total phenolics of Crystal Guava Fruit Leather-Dragon Fruit Leather

Treatment	The concentration of dextrin as an additive (%)	Total Phenol (%)
P_0	0	2.61 ± 0.01
P_1	1	3.22 ± 0.02
P_2	2	2.74 ± 0.01
P_3	3	3.04 ± 0.01

Based on Table 2. it was found that the total phenol value tends to increase. The increase in the total phenol value is due to the constituent material, namely dragon fruit peel, which is rich in phenols. The highest total phenol obtained is at P_1 (3.22 ± 0.02)%, and the lowest value obtained is at P_0 (2.61 ± 0.01)%. The increase in the total phenol value is influenced by the presence of the constituent material, namely dragon fruit peel, which is known to be rich in phenols. This finding is in line with the experimental results of Wahdaningsih et al. (2017), where the total phenol content in dragon fruit skin reached 39.7 ± 5.39 mg GAE per 100 g wet weight. On the other hand, Zadernowski et al. (2009) stated that the fruit flesh has a phenolic content 20 times lower than the peel. The positive relationship between total phenol content and antioxidant activity has been confirmed in the literature by Chanda et al. (2013). Judging from Table 2, total phenolics in fruit leather showed an increasing trend, which may be due to the ability of dextrin to protect the content of bioactive compounds such as phenols from destruction that can occur due to drying. Phenol compounds belong to the category of volatile compounds that easily evaporate. According to Arif (1987), dextrin is a spiral-shaped molecule that can store several molecules that form the flavor of the product in its spiral helix structure. Therefore, the addition of dextrin can minimize the damage of volatile components during the drying process.

4. Organoleptic Properties of Crystal Guava Fruit Leather-Dragon Fruit Leather

The results of the assessment of organoleptic properties of crystal guava-dragon fruit leather with different dextrin additions can be seen in Table 3.

Table 3. Organoleptic Testing Results of Crystal Guava Fruit Leather-Dragon Fruit Skin

Sensory Attributes	**Treatment**			
	P_0	**P_1**	**P_2**	**P_3**
	--------------------------skor--------------------------			
Color	1.92 ± 0.79^{a}	2.36 ± 1.05^{ab}	2.68 ± 0.83^{b}	2.52 ± 0.75^{b}
Aroma	2.80 ± 0.74^{a}	2.36 ± 0.79^{b}	2.00 ± 0.93^{b}	2.40 ± 0.63^{b}
Taste	2.60 ± 0.74	2.44 ± 0.94	2.44 ± 0.85	2.24 ± 0.70
Texture (plastic)	2.36 ± 1.05	2.20 ± 0.97	2.12 ± 0.81	2.68 ± 0.67

Note: the use of superscripts on different lowercase letters in the same row indicates a significant difference ($p<0.05$). The dextrin addition concentration for Treatments P, P, P_{012}, and P_3 were 0%, 1%, 2%, and 3%, respectively.

Score/assessment criteria:

Color	Aroma	Texture (plastic)	Taste
1 = Not bright	1 = Not strong	1 = Not plasticity	1 = Not acidic
2 = Moderate bright	2 = Moderate strong	2 = Moderate plasticity	2 = Moderate acidic
3 = Bright	3 = Strong	3 = Plasticity	3 = Acidic
4 = Very bright	4 = Very strong	4 = Very plasticity	4 = Very acidic

Differences in dextrin addition showed a significant impact ($p<0.05$) on color attributes. As seen in Table 3, the higher the concentration of dextrin added, the lighter the color of the crystal guava fruit leather - dragon fruit skin. The addition of dextrin acts as a coating agent with a soluble high molecular structure. This concept is in line with the view of Xiang et al. (2021), suggesting that browning reactions can be dampened by reducing physical contact through the coating of soluble high-molecular substances, such as dextrin, gelatin, sodium carboxymethyl cellulose, and so on. After the drying process using a cabinet dryer, the crystal guava fruit leather-dragon fruit leather has a darker color. This change is the result of the caramelization reaction, which occurs due to heating sugar at temperatures above its liquid point, which will result in a change in color from dark to brown. According to Fitranti et al. (2014), the drying process of food can result in changes in chemical and physical properties, resulting in changes in the ability of the material to absorb, reflect, transmit, and spread light, which in turn changes the color of the food. The presence of anthocyanins, which is one of the red-coloring compounds in dragon fruit skin, can change during the heating process.

The results of the descriptive organoleptic properties test in the aroma of crystal guava fruit leather-dragon fruit skin showed that the addition of dextrin with various concentrations had a significant effect ($p<0.05$) on the aroma of the product. The addition of dextrin concentration caused the aroma value to tend to decrease to be moderate strong. This phenomenon occurs because the volatile compounds contained in crystal guava evaporate during the drying process, so small substances are also carried away to evaporate, resulting in reduced aroma intensity. This concept is in line with the view of Anggraini and Handayani (2016), who stated that the decrease in aroma value can be caused by the loss of volatile compounds along with water during the drying process, resulting in some substances that evaporate quickly being carried away. As a result, the aroma after the drying process tends to be weaker than the state of fresh fruit, so the aroma of fruit leather feels moderate strong. In addition, the distinctive aroma of fruit leather is also caused by complex compounds created from essential oils and fast-evaporating compounds. The statement of Stover et al. (1987) supports this concept by stating that the distinctive aroma of fruit arises due to the creation of complex compounds from rapidly evaporating substances and some essential oils. The aroma of fruit leather is influenced by the content of sugars, fatty acids, carotenoids, amino acids, and phenols, which are volatile components that cause aroma precursors. These compounds then contribute to the aroma characteristics of the fruit. Fransisca (2017) also stated that sugars, fats, carotenoids, amino acids, and phenols are volatile substances that cause flavors that can produce aroma precursor compounds, which ultimately give the fruit its characteristic aroma. In addition, processing can also produce aroma compounds through chemical changes (Ladamay, 2014).

The addition of dextrin with varying concentrations had no statistically significant effect ($p>0.05$) on the flavor of crystal guava-dragon fruit leather. All treatments had an average score ranging from 2.24 to 2.6 with moderate sour taste criteria. This was due to the composition of the constituent ingredients of fruit leather, which mainly consisted of crystal guava with a vitamin C content of 18.73 mg. This understanding is in accordance with the view of Sasmi et al. (2022), that crystal guava has good nutritional content, with nutritional values per 100 grams of freshly ripened crystal guava as follows: 0.9 grams of protein, 0.3 grams of fat, 12.2 grams of carbohydrates; 14 milligrams of calcium; 28 milligrams of phosphorus; 1.1 milligrams of iron; 25 SI (International Units) of vitamin B; 18.73 milligrams of vitamin C; 9.2% sugar; and 87.4% water, with total calories of 49 calories. Research by Djanis and Hanafi (2009) also showed that the vitamin C content in the flesh of fruit is higher than in the seeds, especially in the skin component and the soft and thick outer flesh layer. The ingredients that make up the product also contain citric acid, which has the ability to reduce the pH value of fruit leather, giving it a sour taste. This finding is in line with the experiment of Rizkika et al. (2020), who noted that the concentration of citric acid in the product can cause a decrease in pH value.

The test results related to the addition of dextrin in various concentrations showed that statistically, there was no significant effect ($p>0.05$) on the plastic texture of crystal guava fruit

leather - dragon fruit skin. All treatments had an average score ranging from 2.2 to 2.68 with moderate plasticized criteria. Based on the data listed in Table 3, it can be noted that the plastic texture values tended to decrease, although there was a considerable increase in treatment P_3. This phenomenon can be explained by the fact that the addition of dextrin in larger amounts can cause the texture to become denser. Dextrin that is added acts as a thickener and improves the appearance of the product often used as a filler or mixture in various types of food (Lewis, 1989). Meanwhile, the plastic texture of fruit leather is formed through the gelling process. This process occurs during heating in the presence of pectin, sugar, acid, and water (Desrosier, 1988). In principle, gels are formed through the formation of a network structure by primary molecules that span the entire volume of the gel. In the presence of water, cross-linking of the polymers forms long-chain molecules that form a rigid and sturdy three-dimensional structure that can withstand certain pressures and forces (Kennedy et al., 2011).

5. Determination of Best Treatment based on Parameters $_{Aw}$ Crude Fiber, Total Phenol, and Organoleptic Score of Crystal Guava Fruit Leather-Dragon Fruit Peel with Dextrin Addition

Based on the results of testing $_{Aw}$, crude fiber content, total phenols, and organoleptic properties, Table 4 presents the determination of the best treatment on the basis of data for each parameter.

Table 4 Best Treatment Parameters of Fruit Leather with Dextrin Addition

Parameters	Dextrin Addition				Standard
	0%	1%	2%	3%	
Value a_w	-	-	✓	-	<0,7 (Fauziah *et al*., 2016)
Crude Fiber Content	-	✓	-	-	-
Total Phenol	-	✓	-	-	-
Organoleptic					
• Color	-	-	✓	-	Bright
• Aroma	-	-	✓	-	Somewhat Strong
• Taste	-	-	-	✓	Moderate Acidic
• Texture (plastic)	-	-	-	✓	Plastic
Total *check list*	**0**	**2**	**3**	**2**	

Note ✓ = shows better characteristics for each treatment.

Based on Table 4, it is found that the best variant of crystal guava fruit leather-dragon fruit skin is the one with 2% dextrin addition. The treatment has an accumulation of parameter values from the a_w value because it has the lowest a_w value. In addition, the 2% dextrin addition treatment has the appropriate color and aroma organoleptic values, so it is included in the accumulated parameter values.

CONCLUSION

Based on the results of the study, the overall concentration of dextrin added can reduce the value of crude fiber content, aroma, and sour taste and increase total phenols, color brightness, and plastic texture. Overall, the best treatment was the addition of 2% dextrin because it was the treatment that approached the desired criteria or standards. These results indicate that the use of dextrin in fruit leather can improve the organoleptic properties of the fruit leather produced.

REFERENCES

Alftrén, J., J. M. Peñarrieta, B. Bergenståhl, and L. Nilssona. (2012) Comparison of molecular and emulsifying properties of gum Arabic and mesquite gum using asymmetrical flow field-flow fractionation. Food Hydrocolloids Journal. p. 54–62.

Anggraini, S.R. (2016). Pengaruh penambahan labu kuning dan karagenan terhadap hasil jadi *fruit leather* nanas. Jurnal Online Boga. 5(1), 89-98.

AOAC. (2007). Official Method of Analysis. The Association of Analytical Chemist Inc., Gaithersburg.

Arief, D. Z. (2018). Karakteristik *fruit leather* jambu biji merah (*Psidium guajava L*.) dengan jenis bahan pengisi. Jurnal Pasundan Food Technology. 5(1), 76-83.

Badan Standardisasi Nasional. (2015). Produk Pangan Pertanian – Penentuan Kadar Serat Kasar – Metode Umum. SNI ISO 5498:2015. Standar Nasional Indonesia, Jakarta.

Chanda, S., N. Amrutiya, and K. Rakholiya. (2013). Evaluation of antioxidant properties of some indian vegetable and fruit wastes viz. lime pell, spent guava extract, aplle pomace etc. Journal of Food Safety, 13, 391-397.

Desrosier, N. (1988). Teknologi Pengawetan Pangan. Diterjemahkan oleh M. Moeljohardjo. Penerbit Universitas Indonesia, Jakarta.

Djanis, R. L., dan Hanafi. (2009). Aktivitas antioksidan selama pematangan buah jambu biji *(Psidium guajava L.*). Warta Akab, 22, 12–23.

Fauziah, E., E. Widowati, dan W. Atmaka. (2016). Kajian karakteristik sensoris dan fisikokimia *fruit leather* pisang tanduk (*Musa corniculata*) dengan penambahan berbagai konsentrasi karagen. Jurnal Aplikasi Teknologi Pangan. 4(1), 11-16.

Fransisca, A. N. (2017). Perubahan senyawa prekursor aroma dan senyawa volatil buah kepel (*Stelechocarpus burahol*) selama penyimpanan suhu ruang. Fakultas Pertanian. UGM. Yogyakarta. https://etd.repository.ugm.ac.id/penelitian/detail/ 108493

Ingrath, W. (2015). Ekstraksi pigmen antosianin dari kulit buah naga merah (*Hylocereus costaricensis*) sebagai pewarna alami makanan dengan menggunakan *microwave* (kajian waktu pemanasan dengan *microwave* dan penambahan rasio pelarut aquades dan asam sitrat). Jurnal Bioproses Komoditas Tropis. 3(3), 1-8.

Kania, W., MA. M. Andriani, dan Siswanti. 2015. Pengaruh variasi rasio bahan pengikat terhadap karakteristik fisik dan kimia granul minuman fungsional instan kecambah kacang komak (*Lablab purpureus (L.)Sweet*). Jurnal Teknosains Pangan. **4**(3): 16-29.

Kementerian Kesehatan RI. (2018). Hasil Riset Kesehatan Dasar (Riskesdas) 2018. Badan Penelitian dan Pengembangan Kesehatan Kementerian RI, Jakarta.

Kennedy, J. F, G. O. Phillips, and P. A. Williams. (2011). Gum Arabic. Royal Society of Chemistry, London.

Kumalaningsih, Suprayogi, dan Y.M.W. Beni. (2005). Membuat Makanan Siap Saji. Trubus Agrisarana, Surabaya.

Ladamay N.A., dan S. Y. Sudarminto. (2014). Pemanfaatan Bahan Lokal dalam Pembuatan Foodbars (Kajian Rasio Tapioka : Tepung Kacang Hijau dan Proporsi CMC. Jurnal Pangan dan Agroindustri. 2(1), 67-78.

Lagho, A. B. A. (2010). Pembuatan Basis Data Struktur Tiga Dimensi Senyawa Kimia Dari Tanaman Obat di Indonesia. Fakultas Matematika dan Ilmu Pengetahuan Alam. Universitas Indonesia. Depok. https://lib.ui.ac.id/file?file=digital/2016-7/20181374-S33128-Akma%20Bertha%20Aprima%20Lagho.pdf

Lewis, R. (1989). Food Additives Hand Book. Chapman dan Hall Co, New York.

Lukiati, B. (2014). Penentuan aktivitas antioksidan dan kandungan fenol total ekstrak daun gendola (*Basella rubra* Linn) dan daun binahong (*Anredera cordifolia Stennis*) sebagai kandidat obat herbal. Dalam: Seminar Nasional XI Pendidikan Biologi FKIP UNS 2014. Hal. 195-200.

Manurung, F. B., F. Hamzah, dan R. Efendi. (2020). Pemanfaatan bubur kulit pisang kepok dalam pembuatan *fruit leather* jambu biji merah. Jurnal SAGU : Agricultural Science and Technology. 19(2), 10-17.

Permadi, M. R., H. Oktafa, dan K. Agustianto. (2018). Perancangan sistem uji sensoris makanan dengan pengujian *peference test* (hedonik dan mutu hedonik), studi kasus roti tawar, menggunakan algoritma radial basis *function network*. Jurnal Manajemen Informatika. 8(1), 29-42.

Putri, N. K. M., I. W. G. Gunawan, dan I. W. Suarsa. (2015). Aktivitas antioksidan antosianin dalam ekstrak etanol kulit buah naga super merah (*Hylocereus costaricensis*) dan analisis kadar totalnya. Jurnal Kimia. 9(2), 243-251.

Ramadhan, K., A. Windi, dan W. Esti. (2015). kajian pengaruh variasi penambahan xanthan gum terhadap sifat fisik dan kimia serta organoleptik *fruit leather* kulit buah naga daging super merah (*Hylocereus costaricensis*). Jurnal Teknologi Hasil Pertanian. 8(2), 115- 122.

Rizkika, R., N. Harun, dan Rahmayuni. (2021). Penambahan asam sitrat terhadap kualitas tepung pisang batu. Jurnal Online Mahasiswa FAPERTA. 8(2), 1-11.

Sasmi, W. T., M. Sayuti, H. T. Yulianti, dan F. Sulastri. (2022). Manfaat Jambu biji kristal Sebagai Daya Tahan Tubuh di Masa Pandemi Covid-19. Dalam: Konferensi Nasional Penelitian dan Pengabdian (KNPP) Ke-2, 24 Maret 2022. Hal. 902-909.

Stover, R.H., and N.W. Simmons. (1987). Bananas 3rd, Longmans Group, U.K. L.td. Singapore. dalam Noor, Z., 2007. Perilaku Selulose Buah Pisang dalam Penyimpanan Udara Termodifikasi. Dalam: Seminar Nasional Teknologi 2007 (SNT 2007), ISSN: 1978 -9777, Yogyakarta, 24 November 2007.

Suhendar, H. (2021). Teknik Budi Daya Jambu Biji Kristal. Diva Press, Yogyakarta.

Susanto, T. dan B. Saneto. (1994). Teknologi Pengolahan Hasil Pertanian. Bina Ilmu, Surabaya.

Trubus. (2014). Jambu Biji Kristal. Trubus Swadaya, Jakarta

Wahdaningsih, S., S. Wahyuono, S. Riyanto, dan R. Murwati. (2017). Penetapan kadar fenolik total dan flavonoid total ekstrak metanol dan fraksi etil asetat kulit buah naga merah (*Hylocereus polyrhizus* (f.a.c.weber) britton dan rose). Jurnal Ilmiah Farmasi. 6(3), 295-301.

Xiang, J., F. Liu, B. Wang, L. Chen, W. Liu, and S. Tan. (2021). a literature review on Maillard reaction based on milk proteins and carbohydrates in food and pharmaceutical products: advantages, disadvantages, and avoidance strategies. Foods. 10(9).

Xu, J., W. Zhao, Y. Ning, Z. Jin, B. Xu, and X. Xu. (2012). Comparative study of spring dextrin impact on amylose retrogradation. Journal of Agricultural and Food Chemistry. 60(19), 4970–4976.

Yahya, M. H., Y. W. Wulandari, dan Y. A. Widanti. (2022). Formulasi *fruit leather* jambu biji kristal (*Psidium guajava* L.)-Bit (*Beta vulgaris* L.) dengan variasi konsentrasi dekstrin. Jurnal Ilmiah Teknologi dan Industri Pangan UNISRI. 7(1), 30-39.

Zadernowski, R., S. Czaplicki, and M. Naczk. (2009). Phenollis acid profiles of mangosteen fruits. Journal Food Chem, 1(12), 685-689.